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Planck 2015 results: IV. Low Frequency Instrument beams and window functions

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Abstract

© ESO, 2016.This paper presents the characterization of the in-flight beams, the beam window functions, and the associated uncertainties for the Planck Low Frequency Instrument (LFI). The structure of the paper is similar to that presented in the 2013 Planck release; the main differences concern the beam normalization and the delivery of the window functions to be used for polarization analysis. The in-flight assessment of the LFI main beams relies on measurements performed during observations of Jupiter. By stacking data from seven Jupiter transits, the main beam profiles are measured down to -25 dB at 30 and 44 GHz, and down to -30 dB at 70 GHz. It has been confirmed that the agreement between the simulated beams and the measured beams is better than 1% at each LFI frequency band (within the 20 dB contour from the peak, the rms values are 0.1% at 30 and 70 GHz; 0.2% at 44 GHz). Simulated polarized beams are used for the computation of the effective beam window functions. The error budget for the window functions is estimated from both main beam and sidelobe contributions, and accounts for the radiometer band shapes. The total uncertainties in the effective beam window functions are 0.7% and 1% at 30 and 44 GHz, respectively (at $\ell \approx 600$); and 0.5% at 70 GHz (at $\ell \approx 1000$).

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Keywords

Cosmic background radiation, Methods: data analysis, Telescopes